

e

$$J = \frac{1}{2}$$

e MASS

The mass is known much more precisely in u (atomic mass units) than in MeV; see the footnote. The conversion from u to MeV, $1\text{ u} = 931.494013 \pm 0.000037 \text{ MeV}/c^2$ (MOHR 99, the 1998 CODATA value), involves the relatively poorly known electronic charge.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
0.510998902 ± 0.000000021 OUR NEW AVERAGE	[$0.51099907 \pm 0.00000015 \text{ MeV}$ OUR 1998 AVERAGE]		

0.510998902 ± 0.000000021 1 MOHR 99 RVUE 1998 CODATA value

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.51099907 ± 0.00000015	2 FARNHAM	95 CNTR	Penning
0.51099906 ± 0.00000015	3 COHEN	87 RVUE	1986 CODATA value
0.5110034 ± 0.0000014	COHEN	73 RVUE	1973 CODATA value

¹ MOHR 99 (1998 CODATA) value in atomic mass units is 0.0005485799110(12).

² FARNHAM 95 compares cyclotron frequency of trapped electrons with that of a single trapped $^{12}\text{C}^{+6}$ ion. The result is $m_e = 0.0005485799111(12)$ u, where the figure in parenthesis is the 1σ uncertainty in the last digit. The uncertainty after conversion to MeV is dominated by the uncertainty in the electron charge.

³ COHEN 87 (1986 CODATA) value in atomic mass units is 0.000548579903(13). See footnote on FARNHAM 95.

$$(m_{e^+} - m_{e^-}) / m_{\text{average}}$$

A test of *CPT* invariance.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻⁹ (CL = 90%)	[<4 × 10 ⁻⁸ (CL = 90%) OUR 1998 BEST LIMIT]			
<8 × 10⁻⁹	90	4 FEE	93 CNTR	Positronium spectroscopy

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4 × 10 ⁻⁸	90	CHU	84 CNTR	Positronium spectroscopy
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⁴ FEE 93 value is obtained under the assumption that the positronium Rydberg constant is exactly half the hydrogen one.

$$|q_{e^+} + q_{e^-}|/e$$

A test of *CPT* invariance. See also similar tests involving the proton.

VALUE	DOCUMENT ID	TECN	COMMENT
<4 × 10⁻⁸	5 HUGHES	92 RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<2 × 10 ⁻¹⁸	6 SCHAEFER	95 THEO	Vacuum polarization
<1 × 10 ⁻¹⁸	7 MUELLER	92 THEO	Vacuum polarization

⁵ HUGHES 92 uses recent measurements of Rydberg-energy and cyclotron-frequency ratios.

⁶ SCHAEFER 95 removes model dependency of MUELLER 92.

⁷ MUELLER 92 argues that an inequality of the charge magnitudes would, through higher-order vacuum polarization, contribute to the net charge of atoms.

e MAGNETIC MOMENT ANOMALY

$$\mu_e/\mu_B - 1 = (g-2)/2$$

For the most accurate theoretical calculation, see KINOSHITA 81.

VALUE (units 10^{-6})	DOCUMENT ID	TECN	CHG	COMMENT
1159.652187 ± 0.000004 OUR NEW AVERAGE	$[(1159.652193 \pm 0.000010) \times 10^{-6}$			
	OUR 1998 AVERAGE]			
1159.6521869 ± 0.0000041	8 MOHR	99 RVUE	1998 CODATA value	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1159.652193 ± 0.000010	8 COHEN	87 RVUE	1986 CODATA value	
1159.6521884 ± 0.0000043	VANDYCK	87 MRS	— Single electron	
1159.6521879 ± 0.0000043	VANDYCK	87 MRS	— Single positron	

⁸ The CODATA value assumes the $g/2$ values for e^+ and e^- are equal, as required by CPT.

$$(g_{e^+} - g_{e^-}) / g_{\text{average}}$$

A test of CPT invariance.

VALUE (units 10^{-12})	CL%	DOCUMENT ID	TECN	COMMENT
— 0.5 ± 2.1	9	VANDYCK	87 MRS	Penning trap
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 12	95	10 VASSERMAN	87 CNTR	Assumes $m_{e^+} = m_{e^-}$
22 ± 64		SCHWINBERG 81	MRS	Penning trap
9	VANDYCK 87 measured $(g_-/g_+) - 1$ and we converted it.			
10	VASSERMAN 87 measured $(g_+ - g_-)/(g-2)$. We multiplied by $(g-2)/g = 1.2 \times 10^{-3}$.			

e ELECTRIC DIPOLE MOMENT

A nonzero value is forbidden by both T invariance and P invariance.

VALUE (10^{-26} e cm)	CL%	DOCUMENT ID	TECN	COMMENT
0.18 ± 0.12 ± 0.10	11	COMMINS	94 MRS	205 TI beams
• • • We do not use the following data for averages, fits, limits, etc. • • •				
— 0.27 ± 0.83	11 ABDULLAH	90 MRS	205 TI beams	
— 14 ± 24	CHO	89 NMR	TI F molecules	
— 1.5 ± 5.5 ± 1.5	MURTHY	89	Cesium, no B field	
— 50 ± 110	LAMOREAUX	87 NMR	199 Hg	
190 ± 340	SANDARS	75 MRS	Thallium	
70 ± 220	PLAYER	70 MRS	Xenon	
< 300	WEISSKOPF	68 MRS	Cesium	

¹¹ ABDULLAH 90 and COMMINS 94 use the relativistic enhancement of a valence electron's electric dipole moment in a high-Z atom.

e⁻ MEAN LIFE / BRANCHING FRACTION

A test of charge conservation. See the "Note on Testing Charge Conservation and the Pauli Exclusion Principle" following this section in our 1992 edition (Physical Review **D45**, 1 June, Part II (1992), p. VI.10).

Most of these experiments are one of three kinds: Attempts to observe (a) the (K) shell x ray produced when an electron decays without additional energy deposit, e.g., $e^- \rightarrow \nu_e \bar{\nu}_e \nu_e$ ("disappearance" experiments), (b) the 255.5 keV gamma ray produced in $e^- \rightarrow \nu_e \gamma$, and (c) nuclear de-excitation gamma rays after the electron disappears from an atomic shell and the nucleus is left in an excited state. The last can include both weak boson and photon mediating processes. We use the best "disappearance" limit for the Summary Tables. The best limit for the specific channel $e^- \rightarrow \nu \gamma$ is much better.

Note that we use the mean life rather than the half life, which is often reported.

VALUE (yr)	CL%	DOCUMENT ID	TECN	COMMENT
>4.2 × 10²⁴ (CL = 68%)		[>4.3 × 10 ²³ yr (CL = 68%) OUR 1998 BEST LIMIT]		
>4.2 × 10²⁴	68	BELLI	99	DAMA I L-shell disappearance
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>6.4 × 10 ²⁴	68	12 BELLI	99B DAMA	Disappearance in ¹²⁹ Xe
>2.4 × 10 ²³	90	13 BELLI	99D DAMA	Disappear in ¹²⁷ I (in NaI)
>4.3 × 10 ²³	68	AHARONOV	95B CNTR	Ge K-shell disappearance
>3.7 × 10 ²⁵	68	AHARONOV	95B CNTR	$e^- \rightarrow \nu \gamma$
>2.35 × 10 ²⁵	68	BALYSH	93 CNTR	$e^- \rightarrow \nu \gamma$, ⁷⁶ Ge detector
>2.7 × 10 ²³	68	REUSSER	91 CNTR	Ge K-shell disappearance
>1.5 × 10 ²⁵	68	AVIGNONE	86 CNTR	$e^- \rightarrow \nu \gamma$
>1 × 10 ³⁹		¹⁴ ORITO	85 ASTR	Astrophysical argument
>3 × 10 ²³	68	BELLOTTI	83B CNTR	$e^- \rightarrow \nu \gamma$
>2 × 10 ²²	68	BELLOTTI	83B CNTR	Ge K-shell disappearance

¹² BELLI 99B limit on charge nonconserving e^- capture involving excitation of the 236.1 keV nuclear state of ¹²⁹Xe. Less stringent limits for other states are also given.

¹³ BELLI 99D limit on charge nonconserving e^- capture involving excitation of the 57.6 keV nuclear state of ¹²⁷I. Less stringent limits for the other states and for the state of ²³Na are also given.

¹⁴ ORITO 85 assumes that electromagnetic forces extend out to large enough distances and that the age of our galaxy is 10^{10} years.

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